Amended by Article 34

CLAIMS

1. A method of determining an acoustic velocity in a bone, comprising:

transmitting, from a location adjacent a first in-vivo bone, an acoustic wave having a wavelength about the same or smaller than a cross-section of the bone, which cross-section is perpendicular to a main travel direction of said acoustic wave in said bone;

receiving said acoustic wave at a location adjacent a second in-vivo bone; and

determining an acoustic velocity of at least a portion of at least one of the first and second bones, from a travel time of said wave through said first and second bones and at least one joint between said bones.

2. A method according to claim 1, wherein said locations have an unknown positional relationship.

3. A method according to claim 1, wherein said locations have a known positional relationship.

4. A method according to claim 1, wherein said receiving and said transmitting comprise receiving and transmitting using mechanically coupled acoustic elements.

5. A method according to claim 1, wherein said receiving and said transmitting comprise receiving and transmitting using mechanically uncoupled acoustic elements.

6. A method of determining a characteristic of a bone, comprising:

transmitting, from a location adjacent a first in-vivo bone, an acoustic wave having a frequency of at least 20kHz;

receiving said acoustic wave at a location adjacent a second in-vivo bone; and

determining at least one acoustic characteristic of at least a portion of at least one of the first and second bones, from a travel time of said wave through said first and second bones and at least one joint between said bones.

7. A method according to claim 6, wherein said acoustic characteristic comprises acoustic velocity.

8. A method according to claim 6, wherein said acoustic characteristic comprises acoustic attenuation.

9. A method according to claim 6, wherein said acoustic characteristic comprises polarization properties.

10. A method according to any of claims 7-9, wherein said acoustic characteristics are determined for a plurality of wavelengths, to estimate a frequency dependent variation thereof.

11. A method according to any of claims 1-10, wherein the joint is articulated.

12. A method according to any of claims 1-10, wherein said first and second bones are interconnected by at least a third bone and wherein said at least one joint comprises at least one joint interconnecting said first bone and said at least third bone and at least a second joint interconnecting said at least third and said second bones.

13. A method according to claim 12, wherein said at least a third bone comprises at least two bones interconnected by a joint, through which the wave travels.

14. A method according to any of claims 1-13, wherein said wave travels between an elbow and a finger.

15. A method according to any of claims 1-13, wherein said wave travels between an elbow and a knuckle.

16. A method according to any of claims 1-13, wherein said wave travels between a knee and an ankle.

17. A method according to any of claims 1-13, wherein said wave travels between a trochanter and an pelvis.

18. A method according to any of claims 1-13, wherein said wave travels between two hips.

19. A method according to any of claims 1-13, wherein said wave travels along a rib.

20. A method according to any of claims 1-13, wherein said wave travels along a portion of a skull.

21. A method according to any of claims 1-13, wherein said bones comprise spinal vertebra.

22. A method according to any of claims 1-21, wherein receiving the acoustic wave comprises receiving at least a second acoustic wave, which second wave has a path substantially overlapping a path in bone of said first wave for a significant portion of its length.

23. A method according to claim 22, wherein the two waves are received using a single receiver and are generated at two different locations.

24. A method according to claim 22, wherein the two waves are received using two receivers and are generated at a single location.

25. A method according to claim 24, wherein a line interconnecting said two receivers is not parallel to a surface of bone underlying the two receivers.

26. A method according to any of claims 22-25, wherein said travel time comprises a relative travel time of said two waves.

27. A method according to any of claims 22-26, wherein said two waves are generated substantially simultaneously.

28. A method according to any of claims 22-26, wherein said two waves are generated as a single source wave.

29. A method according to any of claims 22-26, wherein said two waves are generated at a time delayed relative to each other.

30. A method according to any of claims 1-29, comprising repeating said transmitting and said receiving for at least a second acoustic wave, traveling in a direction substantially opposite a traveling direction of said wave, to determine local acoustic bone characteristics at

an area which is traversed by both of said waves.

31. A method of determining an acoustic bone characteristic, comprising:

transmitting an acoustic wave from a first location adjacent a first bone;

receiving said acoustic wave at at least two locations adjacent a second bone, near each other, said locations being significantly distanced from said first location, such that said wave travels substantially overlapping paths from said first location to a location near said two locations; and

determining an acoustic characteristic of the bone adjacent said two locations from said received signals.

32. A method of determining an acoustic bone characteristic, comprising:

transmitting an acoustic wave from a first location adjacent a body;

receiving said acoustic wave at at least two locations adjacent a bone, near each other, said locations defining a line non-parallel to the bone surface and significantly distanced from said first location, such that said wave travels substantially overlapping paths from said first location to a location near said two locations; and

determining an acoustic characteristic of the bone adjacent said two locations from said received signals.

33. A method according to claim 32, wherein said first location is adjacent said bone.

34. A method according to claim 32, wherein said first location is adjacent a different bone.

35. A method according to any of claims 32-34, wherein said transmitting and said receiving utilize two mechanically uncoupled elements.

36. A method according to any of claims 32-34, wherein said transmitting and said receiving utilize two mechanically coupled elements.

37. A method according to any of claims 32-36, wherein said characteristic comprises a trabecular velocity of the bone.

38. A method according to any of claims 32-36, wherein said characteristic comprises a cortical velocity of the bone.

39. A method according to any of claims 32-36, comprising further receiving a second wave at or near said two locations from a second source at a second location, significantly displaced from said two locations and using said received second wave in determining said characteristic.

40. A method according to claim 39, wherein said second significantly displaced source is on a substantially opposite side of said at least two locations, from said first location.

41. A method according to any of claims 32-40, wherein all of said locations are not collinear.

42. A method according to any of claims 32-40, wherein all of said locations are not coplanar.

43. A method of determining a property of a bone, comprising:

transmitting an acoustic wave having a frequency of above 20 kHz along an axis of said bone, through at least a core thereof;

receiving said wave after said travel; and

analyzing said received wave to determine at least one acoustic characteristic of said bone.

44. A method according to claim 43, wherein said acoustic characteristic comprises an acoustic velocity.

45. A method of bone velocity measurement, comprising:

transmitting at least one acoustic wave into a bone at a first location;

receiving said wave at at least two locations outside said bone, after is passes through said bone, wherein said first location and said at least two locations are not collinear; and

determining a trabecular velocity of said bone from said received wave.

46. A method according to claim 45, wherein said bone comprises an ankle bone.

47. A method of determining an acoustic velocity in a bone, comprising:

transmitting an acoustic wave from a first location adjacent an in-vivo bone;

receiving said acoustic wave at a second location adjacent the bone, which second location has an unknown positional relationship relative to said first location; and

determining an acoustic velocity of at least a portion of said bone, from a travel time of said wave between said first and said second locations.

48. A method according to claim 47, wherein receiving comprises receiving using two receivers.

49. A method according to claim 48 and including a difference in time of receipt of the wave by said two receivers, wherein determining comprises determining from said time difference.

50. Apparatus for determining an acoustic velocity in at least a portion of an in-vivo bone, comprising:

a transmitter for generating acoustic signals;

at least one receiver, mechanically uncoupled to said transmitter, for receiving said generated acoustic signals after they travel through a bone; and

circuitry for determining an acoustic velocity in said bone responsive to said received wave.

51. Apparatus according to claim 50, wherein said circuitry determines said velocity responsive to a relative arrival time of said wave.

52. Apparatus according to claim 50 or 51, wherein said at least one receiver comprises at least two receivers.

53. A method according to claim 52 and including a difference in time of receipt of the wave by said two receivers, wherein determining comprises determining from said time difference.